

## Lab No. 6: Study of Internet layer protocols (TCP/IP)

The Internet layer is very important; it defines the datagrams (data packets of the IP layer). It allows the routing of datagrams to remote machines. This flow of packets (datagrams) is managed by the IP protocol. This layer contains, among others, 3 main protocols (IP, ARP, ICMP).

### Exercise 1: The IP Datagram

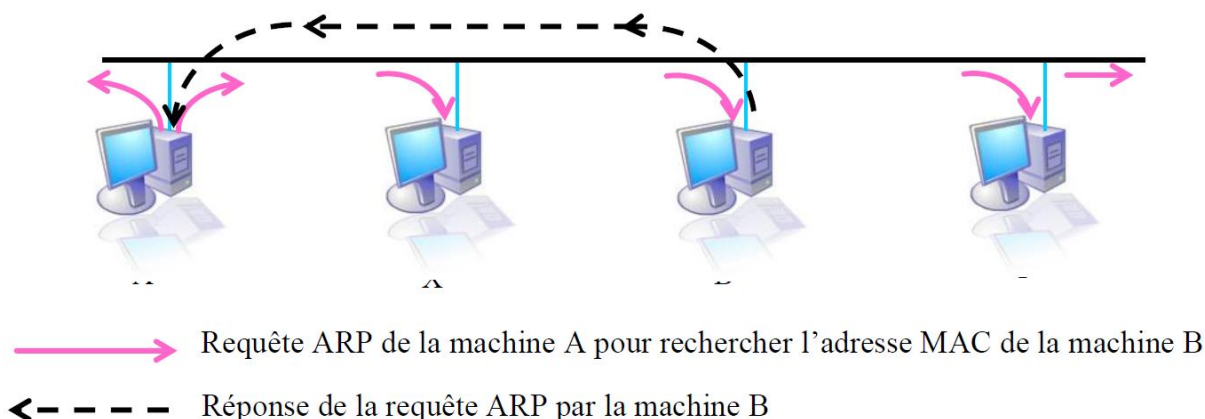
32 bits			
Version (4 bits)	Longueur d'en-tête (4 bits)	Type de service (8 bits)	Longueur totale (16 bits)
Identification (16 bits)		Drapeau (3 bits)	Décalage fragment (13 bits)
Durée de vie (8 bits)	Protocole (8 bits)		Somme de contrôle en-tête (16 bits)
Adresse IP source (32 bits)			
Adresse IP destination (32 bits)			
Données			

The IP datagram is the packet format defined by the IP protocol (at the Internet layer).

1. Start a network capture and collect, in a table (see the figure above), the different information of an IP datagram (i.e., the values in the 'Internet Protocol' line in the B section of the ETHEREAL window).
2. Critique the different values of the datagram header.

**Note:** In each application exercise, stop the capture after each launch to facilitate the visualization of the different packets.

### Exercise 2: The ARP Protocol



It is recalled that communication between machines can only occur through the physical interface. Applications only know IP addresses. To establish the link between IP address/physical address, TCP/IP uses the ARP protocol (Address Resolution Protocol, the working principle of which is explained during the course). For this exercise, we want to study the ARP table that holds the IP address/physical address

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mappings on each machine.

1. To display the content of this table, type the command in MS-DOS: `arp -a`. What is the result?

Now, we want to study the contents of the ARP packet. To do this, clear the ARP table of the machines with the command `arp -d`, configure ETHEREAL to capture only ARP packets (in the capture menu/options, then in the capture filter field, enter `arp`), launch ETHEREAL, and then run a simple ping command from machine A to machine B on the local network.

2. What is the new content of the ARP table?
3. Retrieve the different information related to the packets: ARP request and ARP response — that is, the values of the 'Address Resolution Protocol' line in section B of the ETHEREAL window for each selected ARP packet type.

### Exercise 3: The ICMP Protocol

It is recalled that the ICMP (Internet Control Message Protocol) allows sending control or error messages to other machines or gateways. For example: When a station encounters a problem during the reception of a datagram, it returns an ICMP message to the source station to signal the issue. ICMP is also used to test the network (the ping command).

This protocol is associated with layer 3 but is itself encapsulated by IP as if it were in layer 4 (Transport). The format of the ICMP header varies depending on the type of message it carries. In this section, we study an example of ICMP messages that are used by the ping command (the operating principle is explained during the course).

For this, configure ETHEREAL to capture only ICMP packets (in the capture menu/options, then in the capture filter field, enter `icmp`), launch ETHEREAL, and then run the `ping -n 10` command (the `-n` option is used to specify the number of ICMP packets to send, 10 in our case) from machine A to machine B on the local network.

1. Verify with the ETHEREAL software the location of the ICMP protocol relative to the IP datagram.